

which this dangerous substance deserves, and manufacturers and users of it will find much valuable information regarding precautionary measures in dealing with this explosive or with the dynamites, of which it forms practically the only explosive ingredient. But neither gun-cotton nor dynamite would be of much service without the detonator, which consists of a copper capsule filled with that curious substance, fulminate of mercury. The production of this material is briefly described, and an attempt is made to elucidate its chemical constitution; the subsequent charging of caps and detonators is dealt with at greater length. In connection with the late terrible explosion of dynamite at Johannesburg, it is stated that the detonators and dynamite were carried in the same railway truck; and if this really were so, no surer means of producing an "accidental" explosion could have been devised.

Users of the so-called safety explosives—ammonite, bellite, &c.—will be interested in tracing the preparation of the different ingredients, the principal of which is generally one of the nitro-compounds of benzene.

The subject of smokeless powders is treated well, and the different machines used are illustrated in such a manner as to show their general construction and essential parts. The manufacture of cordite, as carried out at the Government factory at Waltham Abbey, is one of the most interesting, inasmuch as it is the powder adopted by the War Office for use in rifles and in guns of all calibres. The procedure is, however, somewhat varied in private factories, as, for instance, the cordite paste, instead of being mixed by hand, is sometimes mixed more or less mechanically under water, and in consequence handling the paste is to a large extent dispensed with. Handling substances containing nitro-glycerine for the first time frequently produce most distressing symptoms, due to the absorption of the nitro-glycerine by the skin, the operator being seized with violent headache, or often with vomiting; these symptoms, however, rapidly disappear in the course of a day or two. The complexion of those employed is much improved, and on this account there is a great competition for employment among the young women of the district, it being considered a sure road to matrimony.

The last portion of the work is devoted, more or less, to the description of the apparatus used in the examination of explosives; some of the instruments belonging, let us hope, to a bygone age, are of the most crude description, but there are included some of the more refined instruments employed at the present time. Very little, indeed, is said about the results obtained from ordinary powder, or from the modern explosives; and to those who are interested in the new powders as propelling agents, the question of the energy that can be developed by them, and the conditions under which such energy can be efficiently and satisfactorily utilised, is of the highest importance. So far as we know, the most complete and extensive series of experiments on this subject, and on certain kindred researches, has been made in this country principally at Elswick, and some interesting results have been obtained.

Should a new edition of the work be called for, no

doubt some of the debatable points would receive revision; and we would also recommend the author not to make the same indiscriminate use of the Centigrade and Fahrenheit thermometric scales which appears in the present edition; both volumes, however, show very conclusively the large amount of engineering skill Mr. Guttmann has brought to bear in their production.

H.

ENTOMOLOGY AND EVOLUTION.

Handbuch der paläarktischen Gross-Schmetterlinge für Forscher und Sammler. Von Dr. M. Standfuss. Pp. xii + 392; eight plates. (Jena: Gustav Fischer, 1896.)

IT has long been recognised that the class of insects is particularly rich in good material for the elucidation of many important biological problems; and in the hands of Bates, Wallace, Meldola, Poulton, Merrifield, Fritz Müller, Weismann and others both in this country and abroad, to say nothing of Darwin himself, the lepidoptera, and especially the butterflies, have been largely turned to account in elaborating the details of the picture of organic evolution. Notwithstanding all that has been done both by way of observation and experiment in this direction, it can hardly be questioned that the author of the book before us is right in asserting that the work of systematic entomologists has not been made so profitable to science as it might have been; and that entomological literature has hitherto been overlooked, with some justice, by scientific zoologists. In re-editing with large additions his former useful "*Handbuch für Sammler der europäischen Gross-Schmetterlinge*," Dr. Standfuss has proposed to himself the laudable aim of raising the "*Cinderella of the Sciences*" to a position more worthy of her intrinsic merit; and his method of so doing is to combine a full account of his own experiments and speculations on various points of biological interest with the practical directions of a manual for collectors. The result is the substantial volume before us, which the author hopes will serve as a stimulus to the "mere collector" to direct some of his energies into channels which may lead to really important scientific results. There can be no doubt that Dr. Standfuss has thrown himself into his task with great vigour and enthusiasm. The experiments recorded in this book were conducted on a very large scale, and must have laid a severe tax on the industry and perseverance of their originator. Any one with experience in this direction will have some idea of what is involved in the rearing of more than 7000 lepidopterous larvæ through their various stages, under varying conditions, and in keeping full records of the results. Whether the ordinary collector will be stirred into emulation of these achievements is perhaps doubtful, but Dr. Standfuss has certainly done his best to show him how much interest may attach to the study of butterflies and moths when conducted with a definite scientific object.

The practical part of the book needs little comment. It treats of the usual topics to be found in works of the kind in a plain and serviceable manner. The advice given is sound and sensible, and bears evidence of being the fruit of the author's own experience. We note that

the diseases of larvæ and pupæ are dealt with at greater length than is often the case in similar manuals. With regard to the section on the care of a collection, our own opinion would be in favour of considerably amplifying the suggestions here thrown out as to labelling and register-keeping.

It is, however, to the experimental and speculative part of the work that the scientific reader will turn with most interest. Here he will find a large mass of valuable material; consisting in the chief place of elaborate records of the author's own experiments. The first subjects dealt with are those of hybridisation, the respective influence of the male and female parent on the structure and appearance of the hybrid progeny, the fertility of crosses, the production or suppression of intermediate forms. The value of well-planned and systematic experiments on these points cannot be easily over-estimated. The importance of the subject has been fully recognised by Darwin, Wallace, Galton and Weismann amongst others, but the comparative absence of quantitative results such as Dr. Standfuss gives us, and the consequent impossibility of applying any measurement to the forces at work, has hitherto prevented the facts of hybridisation, their relation to fertility, and their bearing on questions of heredity and species-formation, from having their due weight in the discussion of biological problems. Another large and most interesting group of experiments centres round the question of the effect of abnormal external conditions, during the immature stages, upon the form of the perfect insect. The author has here taken as his model the well-known temperature experiments of Dorfmeister, Weismann and W. H. Edwards upon lepidopterous pupæ, elaborating the conditions and extending his investigations over a wider range of material. It is remarkable that the species selected by him as the subjects of experiment were in very many cases the same as those used by Merrifield, who had already been working quite independently on similar lines, and most of whose results, published before those of our author saw the light, are in close agreement with the latter. The work of each experimenter thus receives independent confirmation from that of the other.

While there can be no question of the remarkable interest attaching to the effects obtained by these temperature-experiments upon pupæ, and while it will be generally allowed that much gratitude is due to Dr. Standfuss for his assiduity in conducting and recording the large number of experiments here referred to, and in accurately describing their results, there will be much difference of opinion as to the value of his interpretations. Dr. Standfuss's own views on the subject of evolution may be shortly stated. He believes in the hereditary transmissibility of acquired characters; and without enunciating any definite theory of the nature of pangenesis, he argues in favour of a centripetal mode of germ-formation. Variations are, according to him, produced by the direct effect of the environment on the parent organism, and the principle of natural selection is limited in operation, many species having become established without its aid. The theory of mimicry, he thinks, has certainly to be reckoned with, but great caution must be used in applying it to the explanation of any given case.

Of Fritz Müller's development of the mimicry theory, in consideration of which many of his objections would lose their force, he takes no notice. From all this it may be seen that our author is a pronounced Neo-Lamarckian. Space would not allow us to follow him in all his speculative arguments, which, though often far-fetched and sometimes demonstrably erroneous, are always ingenious and interesting. Recognising the extreme value of facts in reference to such a question as that of the true nature of heredity, we have carefully searched the whole volume for any unequivocal instance of the genuine transmission of an acquired character, and we are bound to say that we have not found one, unless in the sense admitted by Weismann ("The Germ-Plasm," 1893, p. 401), which, strictly speaking, is not a matter of heredity at all. The author has evidently convinced himself that several of his results are to be interpreted in the former, viz. the Lamarckian way. For our own part, we can only say that they seem to us to be all capable of other explanations; and that in spite of the difficulty he alleges (p. 292), the only means of attempting a satisfactory solution of this question, as it appears to us, would be a careful experimental inquiry pursued through several generations. For this purpose some species should be sought for which is at the same time capable of partial domestication, and possesses distinctive features of colour and pattern which are fairly sensitive to external influences. An argument against Dr. Standfuss's view of species-formation is afforded by the curious reversionary character of many of the changes produced by exposure of the pupa to abnormal conditions of temperature. The ancestral features thus revived are sometimes of so very distinct and special a kind, that it seems scarcely adequate to regard them, as he does, simply as the direct effect of temperature conditions similar to those under which the ancestral form came into existence. But our author practically ignores the possible influence of sexual selection and of the necessity for recognition in the production of characteristic external markings, and with him "adaptation" as applied to these markings means little else than protective resemblance. Hence, probably, his limited view of the action of natural selection, and his readiness to attribute the distinct aspects of the various species of *Vanessa* and other groups to direct climatic influences, *plus* isolation. Still, whatever may be the omissions and shortcomings of the book from the theoretical point of view, of which much more could be said, its value as a great quarry of facts is undeniable, and the author makes no attempt to present his experimental results in any but the most fair and impartial manner.

The value of the descriptions is greatly increased by the excellent plates, which are very well executed and really illustrative of the text. The book is well printed; we have only discovered a very few misprints in the text, and one small inaccuracy in one of the plates. The want of a general index is a serious drawback. Taking the work as a whole, we are bound to say that it is one that challenges the serious attention of biologists, and that whatever may be thought of the author's speculations and arguments, the facts that he has collected are of unquestionable interest and importance.

F. A. DIXEY.